3D Realistic Modeling of the Interaction of Quiet-Sun Magnetic Fields with the Chromosphere

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High-resolution observations and 3D simulations suggest that a local dynamo operates near the surface and produces ubiquitous small-scale magnetic elements, thus contributing to the magnetic carpet in the photosphere and to the magnetic structure and dynamics of the solar atmosphere. It appears that the traditional mechanisms of chromospheric energy and mass transport by acoustic waves and shocks are likely to play a secondary role; instead, the primary drivers in the energetics and dynamics of the chromosphere and transition region are small-scale, previously unresolved, quiet-Sun magnetic fields. These fields appear as ubiquitous, rapidly changing (on the scale of a few seconds), tiny magnetic loops and magnetized vortex tubes. Questions then arise about their origin and dynamics in the chromosphere, their links to magnetic fields in the photosphere, and their role in the energy storage and exchange between subsurface layers and the chromosphere. In the talk we will present results of 3D radiative MHD simulations obtained with the StellarBox code and discuss the energetics and dynamical interlinks between the subphotospheric layers and low chromosphere, their effects on the structure of the chromosphere, and signatures of the fine-scale magnetic features in high-resolution spectro-polarimetric observations.